

## User's Manual

# PM-2110 SINGLE PHASE POWER METER



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## PM2110 - Specifications

### PM2110 – OVERVIEW:

The 2110 POWER METER is a solid state Single Phase Power Meter Which accurately measures all quantities of the supply including all types of energies. The 2110 POWER METER is based on ASIC and Micro controller, with a high degree of programmability.

The Meter has been programmed to operate as an intelligent front end measuring and storing device and to communicate continuously to a Master, all the data relevant for the purpose of SCADA, through isolated RS-485 port using MODBUS-RTU protocol.

The Meter is normally supplied readily pre-programmed for operation and can be directly installed in the usual manner. The Meter can be read manually or through a Master using MODBUS-RTU Protocol



### PM2110 – FEATURES:

- The Hardware of the Meter has been designed to make it light weight, rugged, reliable and safe for the user. The Meter is designed so as to provide **ACCESS TO AUTHORISED USERS** only, by providing data security password.
- The Meter is self-powered & uses SMPS of Universal range 80 to 275V AC
- Front panel **LED Output** for purpose of calibration/Accuracy measurement of selected type of energy like: KWh-Import, KWh-Export, KVARh-Lagging, and KVARh-Leading & KVAh
- 12 Parameters Measurement display on selectable screen
- Meter has **2 x 16 LCD** to display various parameters
- **AUTO-SCALING** for measured parameters. (Kilo, Mega & Giga)
- **Four Quadrant** Measurement for PF, Power and Energy.(Active-Reactive)
- **Calibration:** Digital by front panel keys
- **Digital Output:** The Meter has one Pulse Output, which gives Pulse train as per selected energy type.
- Meter is also having Relay output feature in which relay is energized after the set value fixed by user.
- All parameter display & retransmission in RS485

### PM2110'S PARAMETERS:

Parameter	Unit
Frequency	Hz
Power Factor	PF
RMS Voltage	Volt
RMS Current	Amp
Active Power	Watt
Reactive Power	VAr
Apparent Power	VA
Active-Import Energy	KWh-I
Active-Export Energy	KWh-E
Reactive-Lagging Energy	KVARh-L
Reactive -Leading Energy	KVARh-C
Apparent Energy	KVAh
Pulse Output	Wh-I/WH-E/VArh-L/VArh-C/VAh
Relay	Watt/VAr/VA

**PM 2110 TECHNICAL SPECIFICATION:****Input****❖ Nominal Voltage Input**

Direct voltage : Between 57.8V and 275V  
 Nominal voltage : 240V  
 Accuracy Range : 50% – 115% of nominal voltage  
 Burden : < 2.5 VA  
 Overload : 1.2x Nominal (Continuous)  
 PT Ratio : 1 to 9999.999 Programmable  
 Wire gauge : 12 AWG

**❖ Nominal Input Current**

Nominal Current : 1Amp OR 5Amp (Factory settable)  
 Accuracy Range : 5% – 120% nominal  
 Burden : < 0.5 VA  
 Overload : 20.0 Amp Max. (Continuous)  
 CT Ratio : 1 to 9999.999 Programmable  
 Wire gauge : 12 AWG

**❖ Starting current**

0.4% of nominal Current. (Class 1.0)

**❖ Frequency**

50Hz / 60Hz range  $\pm$  5.0Hz

**System**

Single Phase

**Accuracy: (Class 1)**

[Given Accuracy is for PF: 0.5Lag-1.0-0.8Lead]

Volt : 1% rdg  $\pm$  1 dgt.  
 Current : 1% rdg  $\pm$  2 dgt.  
 Frequency : 0.1Hz  $\pm$  1 dgt.  
 Power Factor : 1% rdg  $\pm$  2 dgt. (0.5 Lag - 1.0 - 0.8 Lead)  
 Active Power : 1% rdg  $\pm$  2 dgt.  
 Reactive Power : 2% rdg  $\pm$  2 dgt.  
 Apparent Power : 1% rdg  $\pm$  2 dgt.  
 Active Energy : Class 1.0 (IS 13779/IEC 1036)  
 Reactive Energy : Class 2.0 (IEC 1268)  
 Apparent Energy : Class 1.0

**Output Relay**

Type : Watt/VAR/VA - SPNO  
 Rating : 250V, 2A (AC)  
 :  $\pm$ 30V, 2A (DC)

**Pulse Output**

Type : Wh/VARh/Vah - SPNO  
 Rating : 200V, 100mA, Resistive (AC)  
 :  $\pm$ 200V, 100mA, Resistive (DC)  
 Pulse Rate : 1 to 9999 pulses per selected type  
 Pulse duration : 80 mSec  $\pm$  10%

**Burden**

Less than 5 VA

**Communication Output**

Serial port : RS485 Multidrop  
 Baud rate : Selectable. 4800/9600/19200  
 Start bit : 1  
 Stop bit : 1  
 Protocol : MODBUS – RTU  
 Isolation : 2KV

**Environmental**

Working temperature : 0 to 55 °C  
 Storage temperature : -10 to 70 °C  
 Temperature Coeff : IS-13779  
 Relative humidity : 30 - 95% RH non-condensate  
 Warm up time : 5 min

**Miscellaneous**

Display : 2x16 Backlight LCD module with 5.56 mm  
 Character height  
 Update Rate : 320ms  
 Sensing Method : True RMS sensing on both channels  
 (Simultaneous)

**Enclosure**

Mounting : Panel mounting  
 Cut-Out : 90 mm x 90 mm  
 Enclosure : 96 x 96 x 74.4 mm  
 Material : ABS  
 Accessory : 2 Panel mount clamps  
 Weight : 0.3 Kg

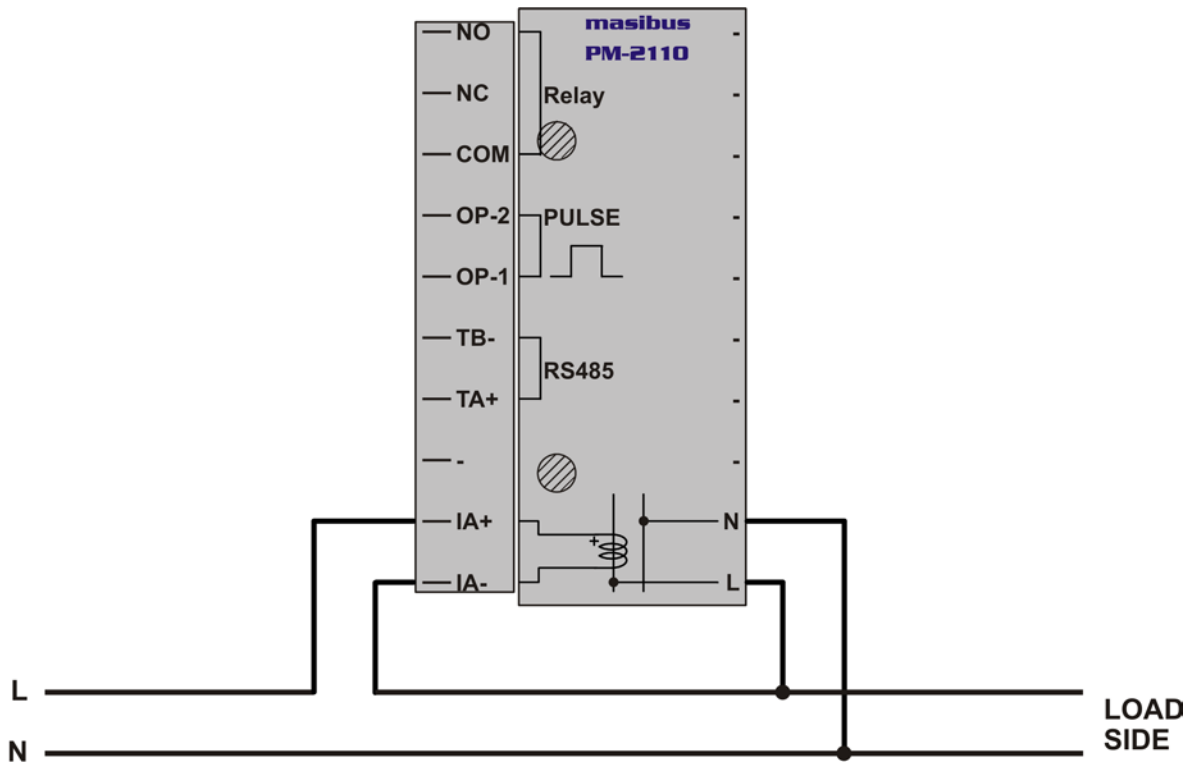
**Resolution for Energy parameters**

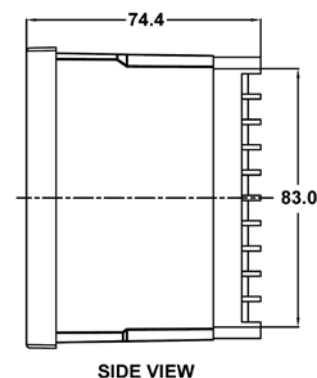
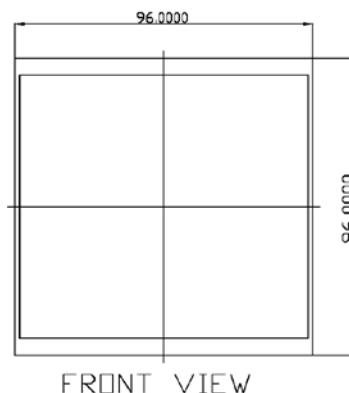
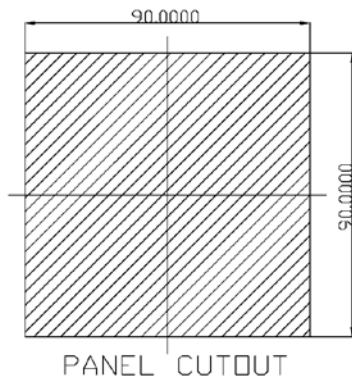
Display Format	Unit	Last Digit Resolution
xxx.xxx	-	0.001 Wh
xxx.xxx	K	1 Wh
xxx.xxx	M	1 KWh
xxx.xxx	G	1 MWh

**PM2110 – WIRING DETAILS:**

The connections have to be made as suggested in the diagram.

Direct connection configuration: (Single Phase Supply)



**PM2110 – Mechanical Dimension Detail:**

(All Dimensions are in mm.)




**Notes:**

Before installing the meter, please go through....

1. Confirm the connection configuration
2. Confirm that all energy parameters are going to start from zero, if not, make them zero.
3. Apply Proper CT – PT Ratio as per requirement.
4. Select Energy type for LED Blinking as per your requirement.
5. Confirm that Meter is calibrated.
6. For Serial communication, MODBUS-RTU, RS485, you will get real/long data from measurement.
7. Factory set Password to access the Program mode is 0001.
8. Some parameters in configuration are only for factory purposes so please don't disturb these parameters like Vrated & Irated.
9. For Front Blinking LED, select energy type (i.e. Wh-import/Wh-export/VArh-lag/VArh-lead/VAh Kilo or Mega units) as per your requirement using Program mode, from OUTPUT and set the value of constant. But here you can get maximum output pulse frequency (& LED Blinking rate) up to 320 ms.so whenever you are using this feature; you should set value of Meter-Constant such a way so it will not cross the limit of 320 ms pulse frequency.  
As pulse frequency is 320 msec, i.e. in one second maximum 3 pulses can be obtained, hence in one hour maximum 10800 pulses can be obtained.  
Example: Meter specification  
Vrate = 240V, I rated = 5A , CT ratio = 40 and PT ratio = 100.  
Above meter can consume maximum of 4.8MWatt. i.e. if it runs at this load for one hour energy consumed by it is 4.8MWattHour. Now if some one has set 3600 pulses/kwh, meter will not generated appropriate pulse. In this case setting should be (10800/4000kwh i.e.) 2.25 pulses per kwh. Taking round figure setting should be 2 pulse/kwh. It can also be set as 2000 pulse/Mwh. i.e. with this load in hour 9600 pulses can be generated, which is less than 10800 i.e. maximum limit.
10. When data type selected for Modbus is LONG, Total apparent Energy will overflow from 200GVAhr the meter will auto reset all energy parameter. This includes Active import and export energy, Reactive lead and lag energy and apparent energy. Such condition of overflow occurrence is depending on CT Ratio and PT ratio.  
Example: For 240V Vrated, and 1 A Irated power meter is set for 5A and 240V line with CT Ratio of 1.0 and PT Ratio of 1.0.  
Energy consumed per hour will be 240V X 5Amps = 1.2KVAHr.  
Time to overflow in Hr. = 200GVAhr / 1.2KVAHr = 166666666 Hr  
Days = 166666666 / 24 = 6944444 Days  
Years = 6944444 / 365 = 19025.84 Years.
11. User has to manually reset all the energy parameter when installing the meter first time.
12. Resolution of the energy parameter on the Modbus when data is transmitted in LONG format is 100VAhr/Whr/VARhr rather than 1VAhr/Whr/VARhr, which is possible when FLOAT data type is used. Because of the limitation of the Long Data type and to avoid frequent reset, Data is transmitted in with above-mentioned resolution.  
Due to this resolution on display of the Meter will not be same as ON Modbus data, when Data is transmitted in LONG format. Multiplication factor given on master side is 0.0001.  
Example: Lets say on Modbus data transmitted is 20098798 then on the master side it will be 20098798\*0.0001 = 2009.8798 MWhr/MVAhr/MVARhr.  
which gives the resolution of the 0.1Khr/KAhR/KARhr as described above.
13. For Enter CT ratio and Pt ratio.  
Example: FOR enter value CTR : 1234.567  
Convert 1234567 in to hex.so hex value is 12D687.  
Now enter lower four byte (D687) at 40016 address.  
After it Higher four byte (0012) at 40015 address.
14. Whenever you want to apply new CT Ratio and/or PT Ratio follow the steps given below:
  1. First note down the Energy Readings.
  2. Now reset all the Energy Parameters.
  3. Apply new CT Ratio and/or PT Ratio.

## PM2110 – Operation

### KEY OPERATION OF 2110:

-  The PGM Key/Enter Key is basically used for PROGRAM mode of operation of 2110.
-  The LEFT SHIFT Key is used to move from one frame of display to another in Vertical direction in the RUN Mode. In the PROGRAM Mode of operation it also acts as an ESC Key.
-  The UP Key is used to move from one frame to frame in Vertical direction in RUN Mode. In the PROGRAM Mode, it is used to move from Line to line on display with arrow cursor and also modify the value of programmable parameters.

The 2110 basically operate in two modes: The **RUN** (Normal) Mode and the **PROGRAM** Mode. The entire operation is shown in brief in the flow diagram below.

### PROGRAM MODE:

The PROGRAM Mode can be entered by pressing the PGM key. Once the key is pressed, the unit prompts for four digit password to enter the programming mode.

#### 1. A.C.INPUTS

Here two parameters are available: CT RATIO, PT RATIO.

#### 2. PLS OUTPUT

Digital Output is meter constant for energy pulse output. Suppose you have set 3600 with its unit KWh-I, so it means that for 1 KWh of consumption of Active-Import Energy by load, it will give 3600 pulses for 1 hour.

Here in unit many options are available like: KWh-I (Active-Import), KWh-E (Active-Export), KVAhL (Reactive-Lagging), KVAhC (Reactive-Leading) & KVAh (Apparent). These all are for kilo unit, and for mega unit: MWh-I, MWh-E, MVAhL, MVAhC & MVAh.

#### 3. SERL COMM.

Here three parameters are available: BAUD, SLV ID and DATA TYPE. BAUD is for Baud-Rate and SLV ID is for Slave Address of Meter for Modbus-RTU (Master-Slave) communication while

DATA TYPE decides the data type in which the meter sends data on RS-485 line. BAUD has three options like 04800, 09600 and 19200, SLV ID should be between 1 and 247 and DATA TYPE has two options REAL (Float) and LONG.

#### 4. RELAY O/P

Here four configuration parameters are available: RLY TIME, TYPE, SV (set value) of POWER and UNIT. TYPE is for the type of power say KW or KVA or KVAh. RLY TIME is settable between 1 to 60 seconds.

When the total power crosses the limit which is set by the user and if it is continuously higher then the set value of relay time in seconds then after that time the relay is energized.

As an example if the set value is 100.000 Watts and relay time is 15 seconds. Now if the total power crosses 100 watts then after 15 seconds relay is energized. If the power drops below 100 watts in between then the relay will not be energized.

#### 5. RESET REGS.

For RESET REGS, Set the arrow before it and press PGM key to enter and screen will be shown like below. By this mode you can reset all energy registers at same time.

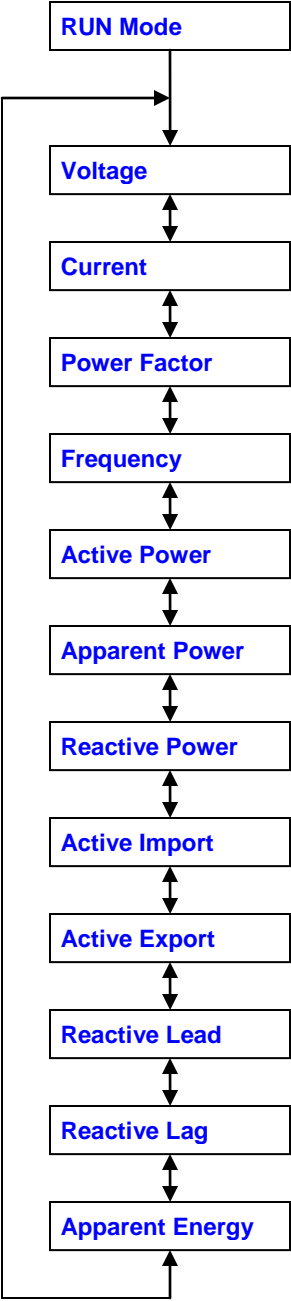


Fig: RUN Mode flow diagram for PM2110.

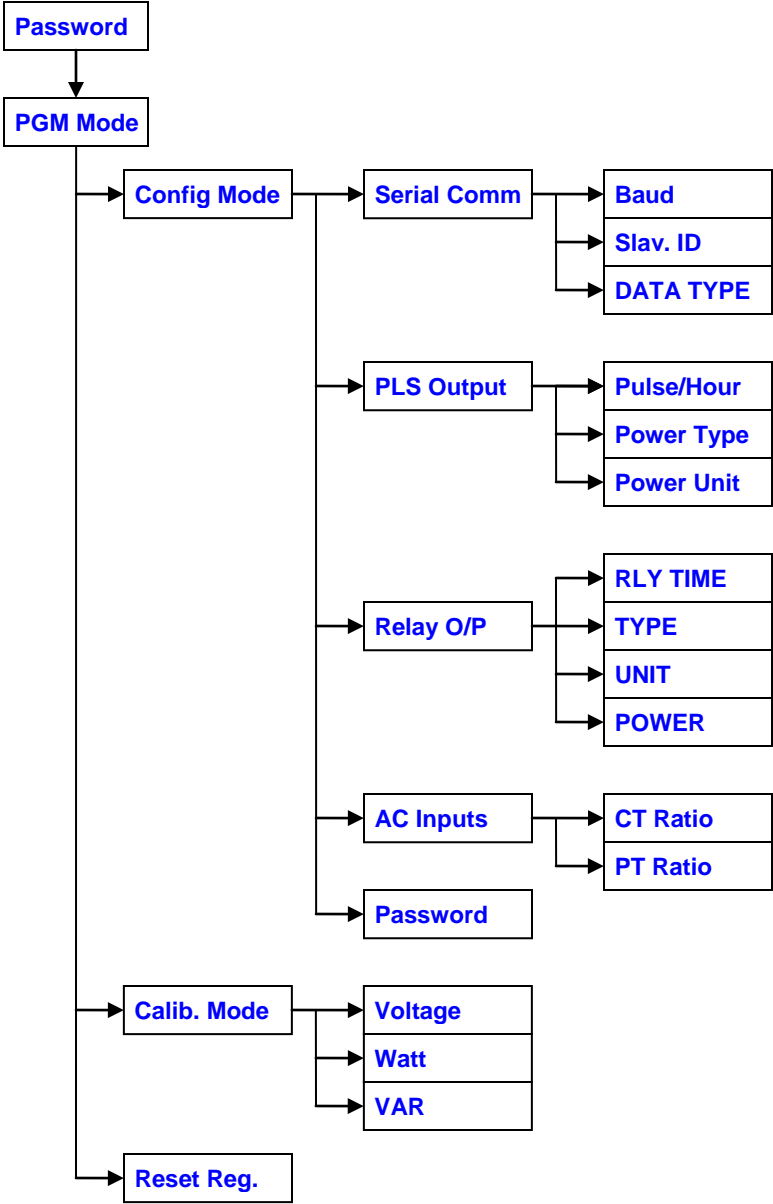


Fig: Programming Mode flow diagram for PM2110.



**CALIBRATION PROCEDURE:****GENERAL:**

For power meter 2110 it will be required to calibrate below given parameters

- a) Voltage.
- b) Active power.
- c) Reactive power.

**Calibration of Voltage Input:**

To do calibration of voltage input follows the given steps

**V-Calib:**

**245 0000250**

- ◆ Feed known around 200V A.C voltage at 50 Hz Frequency to the voltage inputs of the meter.
- ◆ Press PGM key and enter right password to enter the menu screen.

- ◆ Select Voltage Calibration option from CALIB menu.
- ◆ After entering the Voltage calibration you will see un-calibrated voltages on left side and the Set Calibrate voltage on the right side of the LCD screen. Press PGM Key to enter set the Calibrate voltage mode. Now you are in the actual EDIT mode where you can change the Set Voltage using UP & LEFT SHIFT keys to the known input voltage from the voltage source. After you have set the voltage press PGM key to calculate the calibration factor and store it in the EEPROM. Now you will notice that the un-calibrated voltage on the left side will converge near to the set voltage displayed on the right side of the LCD screen. You can repeat this step till un-calibrated voltage is displayed within accepted limits of set voltage. Most probably it will solve by just first try.
- ◆ Finally Press LEFT SHIFT key to return back to main menu.

**Note:** Calibration procedure is same for Active power and Reactive Power

## PM2110 – Serial Guide

### MODBUS Register Map for Power Meter PM2110:

#### Monitoring Parameters

PM2110, (Long / Float) - Function = 03								
Mbus Index	Name	Read/Wr ite	Unit	Resolution	Words	Min	Max	Default
30001	Voltage	R	Volt	1	2			
30003	Current	R	Amp	0.001	2			
30005	Power Factor	R	PF	0.001	2			
30007	Frequency	R	Hz	0.1	2			
30009	Active Power	R	Watt	1	2			
30011	Apparent Power	R	VA	1	2			
30013	Reactive Power	R	VAr	1	2			
30015	Power Factor Type	R		1	2			
30017	Active Import	R	KWh-I	0.1	2			
30019	Active Export	R	KWh-E	0.1	2			
30021	Reactive Lag	R	KVArh-L	0.1	2			
30023	Reactive Lead	R	KVArh-C	0.1	2			
30025	Apparent Energy	R	KVAh	0.1	2			

**Note:** Resolution is for Long only

**Programming Parameter**

<b>PM2110, (Integer) - Function = 04</b>								
<b>Mbus Index</b>	<b>Name</b>	<b>Read/Write</b>	<b>Unit</b>	<b>Resolution</b>	<b>Words</b>	<b>Min</b>	<b>Max</b>	<b>Default</b>
40001	Slave ID	RW		1	1	1	247	1
40002	Baud rate	RW		1	1	0	2	1
40003	Data Type	RW		1	1	0	1	0
40004	Password	-		1	1	1	999	3
40005	Voltage Calibration	RW		0.1	1	1	20000	700.0
40006	Active Power Calibration	RW		0.001	1	1	5000	1.000
40007	Reactive Power Calibration	RW		0.001	1	1	5000	1.000
40008	Pulse per Hour	RW		1	1	1	9999	3600
40009	Pulse op type	RW		1	1	0	2	0
40010	pulse op unit	RW		1	1	0	2	1
40011	relay time	RW		1	1	1	60	15
40012	relay type	RW		1	1	0	2	0
40013	relay unit	RW		1	1	0	2	0
40014	relay power	RW		1	1	1	999	100
40015	ct ratio (H)	RW			1	0	152	0
40016	ct ratio (L)	RW			1	1000	65535	1.000
40017	pt ratio (H)	RW			1	0	152	0
40018	pt ratio (L)	RW			1	1000	65535	1.000
40019	command word	W		1	1	0	65535	0

**Parameter value notifications:**

Parameter	Value=Explanation/Meaning
Power Factor Type	0=Unity 1=Lead 2=Lag 3=Invalid (Zero)
Baud rate	0=19200 1=9600 2=4800
Data Type	0=Long 1=Float/Real
Pulse op type	0=Wh-Import 1=Wh-Export 2=VArh-L (Lag) 3=VArh-C (Lead) 4=VAh
pulse op unit	0=Unity 1=Kilo 2=Mega
relay type	0=Watt 1=VAr 2=VA
relay unit	0=Unity 1=Kilo 2=Mega
command word	11=Reset All Registers 22=Default EEPROM (Init to factory set)

**Note:** > Resolution is for Long only  
> Please do not use factory reset command. It is for Masibus Engineer only.